Pergamon
www.elsevier.com/locate/asr

Adv. Space Res. Vol. 27, No. 10, pp. 1667–1672, 2001

Printed in Great Britain
0273-1177/01 $20.00 + 0.00
PII: S0273-1177(01)00234-4

DYNAMICAL PROCESSES AND CORRELATIONS AT MIDLATITUDES IN THE LOWER AND MIDDLE ATMOSPHERE

A.N.Fahrutdinova, Yu.P.Perevedencev, V.V.Guryanov, V.V. Kulikov.

Kazan State University, Kazan, Russia

ABSTRACT

The wave structure of the zonal circulation has been investigated within the height intervals 1,5 – 12 km, 1,5 – 22,5 km and 80 – 110 km for the spectral region corresponding to the time scales characteristic for the planetary waves (2-30 days). The coherent wave structures in the lower and middle atmosphere have been found to be seasonally and interannually dependent and also show variations with height.

DATA AND METHODS

The formation of the thermodynamic regime of middle atmosphere is influenced by the dynamic processes going on across the whole depth of the atmosphere from the troposphere to the lower thermosphere. In order to investigate both the processes and their intercommunications we carried out the investigations of wave fields of zonal wind using additional experimental data for the heights 1,5 – 12 km, 1,5 – 22,5 km and 80 – 110 km.

Within the height interval 1,5-12 km we used daily data of zonal wind for the grid point (55 N, 50 E) taken from Archive of Objective analysis data (TOGA CD ROM) over the period 1986-1990 for the isobaric surfaces 850, 500, 200 hPa. For the height interval 1,5-22,5 km daily data of radiosounding (56 N, 49 E) interpolated with a height step 1,5 km for the period of 1994 – 1999 were used. For the height interval from 80 km to 110 km over the period 1986 – 1999 we used time series of mean diurnal values of zonal wind velocity, which reflect altitude dependent inter-diurnal variations, which were obtained using the radiometeor method by the radar of Kazan University (56 N, 49 E) [Sidorov V.V., Fahrutdinova A.N., 1991].

Earlier investigations [Fahrutdinova A.N., Ishmuratov R.A., 1996] used the method of maximum likelihood [Wald A., 1949]. This method proposes apriori that the time series is superposition of the final number of a harmonics with certain amplitudes and phases. Then the amplitudes and phases of the proposed harmonics were estimated. In this work the method of autoregression spectral analysis was applied to calculate the autospectra [Marple S.L., 1987]. It allows to separate more detailed distributions of energy in frequencies, corresponding to time scales from 2 to 30 days. The method of autoregression ensures high resolution in frequency, this fact allowed us to detect the frequency dispersion depending on altitude in each region of the spectrum.

HEIGHT-SEASONAL STRUCTURE OF COHERENCE OF WAVE FIELDS IN TROPO-STRATOSPHERE

The main task of the present research was the investigation of the response in the height region 80-110 km to the dynamic processes taking place in the troposphere and stratosphere. For this purpose autospectra, inter-spectra and coherence for time series of the zonal wind in corresponding altitudes have